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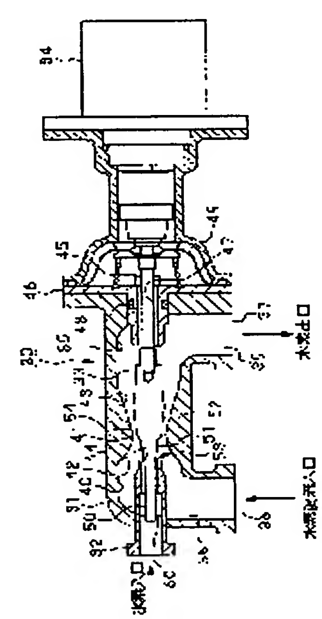
(54) FLUID SUPPLY DEVICE FOR FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To satisfy the requested stoichiometric value in a range from a small flow to a large flow.
SOLUTION: An ejector 30 is provided with a diffuser 31, a nozzle 32, a needle 33 and a driving unit 34. A third passage 40 of the diffuser 31 is provided with a throat part 41 and an enlarged diameter part 43, and the nozzle 32 and the needle 33 are coaxially arranged with the third passage 40. A first tapered part 51 of the needle 33 is inserted into an opening part 44 of the nozzle 32, and a second tapered part 52 is housed in the enlarged diameter part 43. A clearance between the opening part 44 and the first tapered part 51 forms a first fluid passage 53, and a clearance between the enlarged diameter part 43 and the second tapered part 52 forms a second fluid passage 54. The needle 33 is movably provided in the axial direction by the driving unit 43, and both the first and the second fluid passages 53 and 54 can be changed at the same time by moving the needle 33 in the axial direction.



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CLAIMS

[Claim(s)]
[Claim 1] The needle which has the taper section elongated from the point and this point, and the nozzle which it has opening at a head, and the point of said needle makes an axis the same, and is inserted in this opening, and the 1st fluid is supplied inside, and is injected from said opening, The diffuser which attracts the 2nd fluid, is made to join said 1st fluid, and is sent out with the negative pressure which a needle, and said said nozzle and axis are made the same, and it is prepared, and is generated by injection of said 1st fluid, It has the needle positioning means which is moved in said direction of an axis and enables repositioning of said needle. Said 1st fluid is the fluid feeder of the fuel cell characterized by being sent out through the 2nd fluid channel formed of the gap of said taper section and said diffuser after joining the 2nd fluid through the 1st fluid channel formed of the gap of said needle and opening of said nozzle.
[Claim 2] Said needle is the fluid feeder of the fuel cell according to claim 1 characterized by having the predetermined configuration which forms said 1st fluid channel with which the SUTOIKI value set up according to the flow rate is filled, and said 2nd fluid channel.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fluid feeder used for supply systems, such as a fuel of a fuel cell.
[0002]
[Description of the Prior Art] As opposed to the cel which the solid-state macromolecule membrane type fuel cell put the solid-state polyelectrolyte film from both sides with the anode and the cathode conventionally, and was formed It has the stack (it is called a fuel cell to below) constituted by carrying out the laminating of two or more cels. Hydrogen is supplied to an anode as a fuel, air is supplied to a cathode as an oxidizer, the hydrogen ion generated by catalytic reaction in the anode passes the solid-state polyelectrolyte film, and moves even a cathode, and with a cathode, oxygen and electrochemical reaction are caused and it generates electricity.
[0003] Here, in order to maintain the ion conductivity of a solid-state molecule electrolyte membrane, superfluous water is mixed with humidification equipment etc. by the hydrogen supplied to a fuel cell. For this reason, water collects on the gas passageway in the electrode of a fuel cell, and the predetermined blowdown flow rate is set to the blowdown fuel so that this gas passageway may not be closed.
[0004] Under the present circumstances, by mixing and carrying out the recirculation of the blowdown fuel (it being hereafter called hydrogen backflow) to the fuel (namely, hydrogen) newly introduced into a fuel cell, a fuel can be utilized effectively and the energy efficiency of a solid-state macromolecule membrane type fuel cell can be raised. Conventionally, the fuel cell equipment to which the recirculation of the fuel is carried out with an ejector is known like the fuel cell equipment indicated by JP,9-213353,A as fuel cell equipment which was mentioned above.
[0005] If an ejector is explained here, the conventional common ejector projects the nozzle 4 which formed the ** style rooms 2 successively to end face opening of the diffuser 1 which makes the shape of a trumpet, opened the ** style path 3 for free passage in this ** style room 2, made the diffuser 1 and the axis the same and has arranged them as shown in drawing 9 in the ** style room 2, and makes end face opening of a diffuser 1 face that head, and it is constituted. If the hydrogen newly introduced into a fuel cell in this ejector is turned to a diffuser 1 and injected from a nozzle 4, negative pressure will occur in the throat section 5 of a diffuser 1, and the hydrogen backflow introduced into the ** style room 2 by this negative pressure is attracted in a diffuser 1, and the hydrogen and hydrogen backflow which were injected from the nozzle 4 will be mixed, and it will be sent out from the outlet of a diffuser 1. Drawing 10 shows the outline of the pressure distribution in this conventional ejector.
[0006] SUTOIKI is in the index which shows the attraction effectiveness of this ejector. Here, if it says in said example, it will be defined as SUTOIKI as a ratio (Qt/Qa) of the hydrogen flow rate (namely, hydrogen supply full flow supplied to a fuel cell) Qt which flows out of the diffuser to the hydrogen flow rate (namely, hydrogen consumption flow rate) Qa spouted from a nozzle. Moreover, if the hydrogen backflow flow rate attracted by the diffuser from a ** style room is set to Qb, since it is Qt=Qa+Qb, SUTOIKI will be defined as (Qa+Qb)/Qa. Thus, if SUTOIKI is defined, it can be said that attraction effectiveness is large, so that a SUTOIKI value is large.
[0007] By the way, since the diameter of a diffuser and the diameter of a nozzle are being fixed in one ejector in the conventional ejector, it is common to select and use the optimal path respectively at operating fluid-flow within the limits. In this case, the fluid flow rate (if it says in said example, it will be hydrogen consumption flow Q a) from which the SUTOIKI value of an ejector becomes max is determined as a fixed value. A SUTOIKI value becomes small although hydrogen consumption flow Q a will become large, if

hydrogen consumption flow Q a decreases and the diameter of a nozzle becomes large on the other hand, although a SUTOIKI value will rise if drawing 11 shows an example of the experimental result which asked the relation between a SUTOIKI value and hydrogen consumption flow Q a for the diameter of a nozzle as a parameter in the ejector for fuel supply of a fuel cell and the diameter of a nozzle becomes small.

[0008] Here, in the case of the fuel cell, since a hydrogen flow rate changed also ten to 20 times from an idling to output at full gate opening in being a fuel cell powered vehicle after the SUTOIKI value (henceforth a demand SUTOIKI value) demanded according to the operational status of a fuel cell is decided as a thick continuous line shows drawing 11 , it was difficult [it] to continue throughout a hydrogen flow rate with one ejector, and to satisfy a demand SUTOIKI value.

[0009]

[Problem(s) to be Solved by the Invention] In order to avoid this problem, 2 ream change ejector system with a bypass path which changes and uses the ejector for the small flow rates which combined the minor diameter nozzle and the minor diameter diffuser, and the ejector for large flow rates which combined the major-diameter nozzle and the major-diameter diffuser is proposed by these people (application for patent No. 85291 [2000 to]). Although the SUTOIKI engine performance it can continue and be satisfied with the range large in comparison of the engine performance from a small flow rate to a large flow rate was securable by this method, when two ejectors and a passage change means were needed, in order to be the further improvement in the SUTOIKI engine performance, it was necessary the increase of a number, and to carry out and to change [of 3, 4, and an ejector] the ejector of these large number, enlargement of equipment and the increase of weight were caused, and it was disadvantageous.

[0010] Moreover, although it is not an ejector for fuel supply in a fuel cell, the adjustable flow rate ejector is proposed in JP,8-338398,A or JP,9-236013,A. The movable rod is built in in the direction of an axis inside the nozzle, and the adjustable flow rate ejector indicated by JP,8-338398,A enables it to change the opening area at the head of a nozzle by moving this rod in the direction of an axis. In this adjustable flow rate ejector, since the diameter of a diffuser is immobilization while a SUTOIKI value is changeable by changing the opening area at the head of a nozzle, the response relation between a SUTOIKI value and a flow rate is regulated. In this case, the response relation (response relation shown as a thick continuous line in drawing 11) demanded in a fuel cell is set more as a detail, and to advance optimization of a SUTOIKI value is desired.

[0011] On the other hand, the adjustable flow rate ejector indicated by JP,9-236013,A prepares two or more nozzles from which it is made movable in the direction of an axis, or a path differs a nozzle to a diffuser, and makes a nozzle exchangeable. In this adjustable flow rate ejector, since the diameter of a nozzle cannot be changed if nozzles are not exchanged, as that a SUTOIKI value is continuous and an ejector carried in the fuel cell powered vehicle which changes for a short time, it is not suitable. Then, this invention offers the fluid feeder of the fuel cell which can set up the desired SUTOIKI engine performance in a wide range flow rate region.

[0012]

[Means for Solving the Problem] The fuel cell built over invention indicated to claim 1 in order to solve the above-mentioned technical problem The fluid feeder (for example, ejector 30 in the gestalt of operation) of (the fuel cell [for example,] 11 in the gestalt of operation mentioned later) The taper section elongated from the point (for example, straight section 50 in the gestalt of operation), and this point The needle which has for example, (the 1st taper section 51 in the gestalt of operation and the 2nd taper section 52) (for example, 33 in the gestalt of operation), It has opening (for example, opening 44 in the gestalt of operation) at a head, and the point of said needle makes an axis the same and is inserted in this opening. Inside The 1st fluid The nozzle which (for example, the hydrogen in the gestalt of operation) is supplied, and is injected from said opening (for example, nozzle 32 in the gestalt of operation), With the negative pressure which a needle, and said said nozzle and axis are made the same, and it is prepared, and is generated by injection of said 1st fluid, the 2nd fluid The diffuser which attracts (for example, the hydrogen backflow in the gestalt of operation), is made to join said 1st fluid, and is sent out (for example, diffuser 31 in the gestalt of operation), The needle positioning means which is moved in said direction of an axis and enables repositioning of said needle The 1st fluid channel in which it prepares for and said 1st fluid is formed of the gap of said needle and opening of said nozzle (For example, actuator 34 in the gestalt of operation) After joining the 2nd fluid through (for example, the 1st fluid channel 53 in the gestalt of operation), it is characterized by being sent out through the 2nd fluid channel (for example, the 2nd fluid channel 54 in the gestalt of operation) formed of the gap of said taper section and said diffuser.

[0013] Thus, with constituting, if a needle is moved in the direction of an axis with a needle positioning

means, both the opening area of the 1st fluid channel and the opening area of the 2nd fluid channel will change continuously simultaneously. Consequently, the 1st fluid and the 2nd fluid-flow ratio can be continuously changed only by moving a needle in the direction of an axis.

[0014] Invention indicated to claim 2 is characterized by equipping said needle with the predetermined configuration which forms said 1st fluid channel with which the SUTOIKI value set up according to the flow rate is filled, and said 2nd fluid channel in the fluid feeder of said fuel cell according to claim 1. Here, a SUTOIKI value means the ratio of the sum (namely, full flow) of the 1st fluid to the 1st fluid flow, and the 2nd fluid flow. Thus, the SUTOIKI value for which can be continuously changed to the flow rate which asks for the 1st fluid and the 2nd fluid-flow ratio, therefore it asks by repositioning of a needle with constituting can be acquired.

[0015]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the fluid feeder of the fuel cell concerning this invention is explained with reference to the drawing of drawing 8 from drawing 1 . Drawing 1 is system configuration drawing of the fuel-supply system of the fuel cell equipped with the fluid feeder concerning this invention. The fuel-supply system of this fuel cell is carried in cars, such as an electric vehicle, is equipped with a fuel cell 11, the humidification section 13, the oxidizer feed zone 14, the heat exchange section 15, the water separation section 16, an ejector (fluid feeder) 30, and the fuel-supply lateral pressure control section 18, and is constituted.

[0016] The fuel cell 11 consisted of a stack constituted by carrying out the laminating of two or more cels to the cel which put the solid-state polyelectrolyte film which consists for example, of solid-state polymer ion exchange membrane etc. from both sides with the anode and the cathode, and was formed, and is equipped with the fuel electrode with which hydrogen is supplied as a fuel, and the air pole to which the air which contains oxygen as an oxidizer is supplied.

[0017] Air exhaust port 20b in which the air exhaust valve 21 for discharging outside air supply opening 20a to which air is supplied from the oxidizer feed zone 14, the air in an air pole, etc. was formed is prepared in the air pole. On the other hand, 20d of fuel exhaust ports for discharging outside fuel-supply opening 20c to which hydrogen is supplied, the hydrogen in a fuel electrode, etc. is prepared in the fuel electrode.

[0018] It supplies air to the fuel-supply lateral pressure control section 18 while the oxidizer feed zone 14 consists of an air compressor, is controlled according to the input signal from the load and accelerator pedal (graphic display abbreviation) of a fuel cell 11 etc. and supplies air to the air pole of a fuel cell 11 through the heat exchange section 15. The heat exchange section 15 warms the air from the oxidizer feed zone 14 to predetermined temperature, and supplies it to the fuel cell 11.

[0019] The hydrogen as a fuel is supplied to the fuel electrode of a fuel cell 11 from fuel-supply opening 20c through the fuel-supply lateral pressure control section 18, an ejector 30, and the humidification section 13. After the humidification section 13 mixed the steam in the hydrogen supplied and humidified hydrogen, it was supplied to the fuel cell 11, and it has secured the ion conductivity of a solid-state molecule electrolyte membrane. The ejector 30 is formed in the passage which connects the fuel-supply lateral pressure control section 18 and the humidification section 13. Although the configuration of an ejector 30 is explained in full detail by Ushiro, as shown in drawing 1 and drawing 2 , the fuel-supply lateral pressure control section 18 is connected to the nozzle 32 of an ejector 30, and the humidification section 13 is connected to the hydrogen outlet 37 of an ejector 30. And the blowdown fuel discharged from 20d of fuel exhaust ports of a fuel cell 11 is removed in moisture in the water separation section 16, and is supplied to the hydrogen backflow inlet port 36 of an ejector 30 through a check valve 23. An ejector 30 mixes the fuel supplied from the fuel-supply lateral pressure control section 18, and the blowdown fuel discharged from the fuel cell 11, and supplies it to a fuel cell 11.

[0020] The fuel-supply lateral pressure control section 18 consisted of a proportion pressure control valve of for example, an air type, made signal pressure the pressure of the air supplied from the oxidizer feed zone 14, and the fuel which passed the fuel-supply lateral pressure control section 18 has set the pressure which it has at the outlet of the fuel-supply lateral pressure control section 18, i.e., a supply pressure, as a predetermined value.

[0021] Next, an ejector 30 is explained with reference to drawing 2 . The ejector 30 is considering the diffuser 31, the nozzle 32, the needle 33, and the actuator 34 as main configurations. The fluid channel 35 crooked in an abbreviation U shape is formed in the interior of a diffuser 31, opening of the end of this fluid channel 35 is carried out by the appearance of a diffuser 31 as a hydrogen backflow inlet port 36, and opening of the other end is carried out by the appearance of a diffuser 31 as a hydrogen outlet 37. The 1st path 38 which stands in a row at the hydrogen backflow inlet port 36, and the 2nd path 39 which stands in a

row to the hydrogen outlet 37 are arranged mutually at parallel, and both the paths 38 and 39 are connected by the 3rd path 40 which intersects perpendicularly with these.
[0022] The 3rd path 40 has the throat section 41 from which a bore becomes that middle with min, the converging section 42 whose diameter is reduced continuously gradually is formed as it progresses down-stream rather than this throat section 41 at the upstream, and the diameter expansion section 43 whose diameter is expanded continuously gradually is formed as it progresses down-stream rather than the throat section 41 at the downstream. In addition, the breadth include angle of the diameter expansion section 43 is smaller than the breadth include angle of the converging section 42 of the upstream.
[0023] It is made the same, is arranged, nothing, and the 3rd path 40 and axis of a diffuser 31 are transfixed to the diffuser 31, and only the predetermined dimension is locating in the upstream tubed [to which the nozzle 32 carried out opening of the ends] rather than the throat section [in / for the opening 44 by the side of the head of a nozzle 32 / the 3rd path 40] 41.
[0024] In the 3rd path 40 and the nozzle 32, and axis of a diffuser 31, a needle 33 makes it the same, and is arranged and the actuator 34 supports the axis movable in the direction of an axis. The actuator 34 inserted the shaft bearing 47 of the mounting flange 46 by which it consists of a linear actuation mold step motor, and is being fixed to the outer edge surface of the side near the 2nd path 39 in the diffuser 31, and the movable shaft 45 of an actuator 34 was fixed to said outer edge surface of a diffuser 31, and has projected the head in the 3rd path 40. The end face of a needle 33 is being fixed at the head of this movable shaft 45. In addition, the seal of between a diffuser 31 and a mounting flange 46 is carried out by the sealant 48, and the seal of the shaft bearing 47 of a mounting flange 46 is blockaded and carried out by the diaphram 49 built in the actuator 34.
[0025] The amount of point is the straight section 50, the 1st taper sections 51 are formed successively at the end face side of the straight section 50, and, as for the needle 33, the 2nd taper sections 52 are formed successively at the end face side of the 1st taper section 51. In the straight section 50, an outer diameter is fixed, and in the 1st taper section 51 and the 2nd taper section 52, the diameter of each is gradually expanded continuously as it progresses to a end face side. The straight section 50 of this needle 33 is inserted into the nozzle 32 from the opening 44 of a nozzle 32, and is supported possible [sliding] by the needle bearing 60 infixed between a nozzle 32 and the straight section 50. As shown in the sectional view of drawing 3 , the needle bearing 60 has heights 61 and a crevice 62 by turns on the periphery, and hydrogen can circulate a crevice 62 now. And between the openings 44 of a nozzle 32, it has a clearance and a needle 33 locates it while locating the 1st taper section 51 in the converging section 42 of a diffuser 31, and it is locating the 2nd taper section 52 in the diameter expansion section 43 of a diffuser 31. And the 1st fluid channel 53 is formed of the gap of a needle 33 and opening 44, and the 2nd fluid channel 54 is formed of the gap of a needle 33 and the diameter expansion section 43 of a diffuser 31.
[0026] And the hydrogen as a fuel is supplied to a nozzle 32 through the fuel-supply lateral pressure control section 18, and the hydrogen backflow which is the blowdown fuel discharged from the fuel cell 11 is supplied to the 1st path 38 of a diffuser 31. Thus, if hydrogen is supplied to a nozzle 32 and hydrogen backflow is supplied to the 1st path 38 of a diffuser 31 in the constituted ejector 30 The hydrogen injected from the 1st fluid channel 53 flows to the 2nd path 39 through the 2nd fluid channel 54. At this time, negative pressure occurs in the 2nd fluid channel 54 of the downstream a little rather than the throat section 41 and it, and with this negative pressure, the hydrogen backflow in the 1st path 38 is absorbed by the 2nd fluid channel 54, and it mixes with the hydrogen injected from the 1st fluid channel 53, and flows to the 2nd path 39. Drawing 4 shows the outline of the pressure distribution at this time, and can check that negative pressure has occurred in the downstream a little rather than the throat section 41 and it. In addition, the hydrogen and hydrogen backflow which were mixed are sent out from the hydrogen outlet 37 of a diffuser 31, and are supplied to a fuel cell 11 through the humidification section 13.
[0027] Moreover, in the ejector 30 constituted in this way, if the 1st taper section 51 of a needle 33, the 2nd taper section 52, and the diameter expansion section 43 of a diffuser 31 are beforehand formed in the predetermined configuration, the opening area of the 1st fluid channel 53 and the opening area of the 2nd fluid channel 54 can be continuously changed by moving a needle 33 in the direction of a lower stream of a river (it setting to drawing 2 and being the right) from an initial position. So, in the ejector 30 of the gestalt of this operation, the configuration of the diameter expansion section 43 of a diffuser 31, the 1st taper section 51 of a needle 33, and the 2nd taper section 52 was determined as the predetermined configuration as follows.
[0028] First, since in the case of the fuel cell carried in an electric vehicle it was decided as were mentioned above, and the SUTOIKI value (demand SUTOIKI value) demanded according to the operational status of a

fuel cell showed drawing 11 as a thick continuous line, it is necessary to determine the configuration of the 1st taper section 51 that the opening area of the 1st fluid channel 53 with which can be mostly satisfied of the demand SUTOIKI value according to each flow rate is obtained. Here, it is defined as SUTOIKI as a ratio (Qt/Qa) of the hydrogen flow rate (namely, hydrogen supply full flow supplied to a fuel cell) Qt which flows out of the hydrogen outlet 37 of the diffuser 31 to the hydrogen flow rate (namely, hydrogen consumption flow rate) Qa spouted from the 1st fluid channel 53. Moreover, if the hydrogen backflow flow rate attracted by the 2nd fluid channel 54 from the 1st path 38 is set to Qb, since it is Qt=Qa+Qb, SUTOIKI will be defined as (Qa+Qb)/Qa.

[0029] Moreover, in order to bring close to the property of the demand SUTOIKI value and flow rate which are shown by the thick wire of drawing 11 , the artificer of this invention checked by experiment that it was desirable to also enlarge opening area of the 2nd fluid channel 54 as were shown in drawing 5 and he enlarged opening area of the 1st fluid channel 53. Then, the configuration of the diameter expansion section 43 of a diffuser 31 and the 2nd taper section 52 of a needle 33 was determined so that it might change with the axis directional movements of a needle 33 corresponding to the diameter of an optimal nozzle which change of the opening area of the 1st fluid channel 53 shows to drawing 5 based on this experimental result and might change corresponding to the diameter of an optimal diffuser which change of the opening area of the 2nd fluid channel 54 shows to drawing 5 .

[0030] in addition, the part which was comparable as how to carry out change of the opening area of the optimal breadth include angle (8-10 degrees) of the diffuser in the ejector (namely, ejector corresponding to drawing 9) of the type with which the diameter of a diffuser and the diameter of a nozzle are being fixed as for how to carry out change of the opening area of the 2nd fluid channel 54, or took into consideration an increased part of wall surface resistance -- enlarging is desirable.

[0031] Thus, according to the fuel-supply system of the fuel cell which has the constituted ejector 30 By meeting a needle 33 in the direction of an axis by the actuator 34, and approaching or estranging for a nozzle 32 The 1st fluid channel 53 and the 2nd fluid channel 54 can both be continuously changed to coincidence. And when a fuel flow is a small flow rate, opening area of both the 1st fluid channel 53 and the 2nd fluid channel 54 can be made small, and when a fuel flow is a large flow rate, opening area of both the 1st fluid channel 53 and the 2nd fluid channel 54 can be enlarged.

[0032] And a required fuel flow can be sent out to a fuel cell 1, covering the large area of a small flow rate to the large flow rate of a fuel flow, and securing a predetermined SUTOIKI property by controlling an actuator 34 according to the operational status of a fuel cell 1. Drawing 6 is SUTOIKI property drawing which a SUTOIKI value is taken along an axis of ordinate, it takes a hydrogen flow rate along an axis of abscissa, and is shown, and can check that the SUTOIKI property of this ejector 30 approximates and changes to demand SUTOIKI. Moreover, since the above-mentioned effectiveness can be acquired only by moving a needle 33 in the direction of an axis, structure simplification of an ejector, miniaturization, and lightweight-ization can be attained.

[0033] In addition, with the gestalt of operation mentioned above, although the nozzle 32 is fixed to a diffuser 31, a nozzle 32 and a diffuser 31 can be made screwing association, and justification of a nozzle 32 can be enabled along the direction of an axis. thus, the thing for which positioning of a nozzle 32 will be performed if it carries out -- alienation with the opening 44 of a nozzle 32, and the throat section 41 of a diffuser 31 -- dispersion in the process tolerance of a dimension can be made to be able to absorb, or dispersion in the flow-demand property for every real vehicle can be made to absorb Moreover, the initial opening area of the 2nd fluid channel 54 can be adjusted by justifying a nozzle 32 along the direction of an axis. Therefore, as shown in drawing of opening surface ratio change of drawing 7 , the opening surface ratio of the opening area (opening area of a nozzle 32) of the 1st fluid channel 53 and the opening area (opening area of a diffuser 31) of the 2nd fluid channel 54 can be tuned finely.

[0034] Drawing 8 is drawing showing the modification of said ejector 30. In the ejector 30 of the gestalt of said operation, the 1st path 38 and the 2nd path 39 of a diffuser 31 are prepared so that it may intersect perpendicularly with the 3rd path 40, but since the flow direction of a fluid will change suddenly if a fluid channel 35 is constituted in this way, passage resistance will become large. So, in this modification, while each connects aslant the 1st path 38 and the 2nd path 39 to the 3rd path, passage resistance is decreased by forming the 2nd two path 39. Since it is the same as that of the ejector 30 of the gestalt of said operation about other configurations, the same sign is given to the same mode part, and explanation is omitted. In addition, this invention is not restricted to the gestalt of operation mentioned above. For example, if an actuator 34 is not restricted to a linear actuation mold step motor and can justify a needle 33 in the direction of an axis, it is also possible to use other driving means.

[0035]
[Effect of the Invention] Since the 1st fluid and the 2nd fluid-flow ratio can be continuously changed according to invention indicated to claim 1 as explained above, the outstanding effectiveness that the full flow for which it asks, covering the large area of a small flow rate to a large flow rate, and securing a desired SUTOIKI value is also securable is done so. Moreover, only by moving a needle in the direction of an axis, since the 1st fluid and the 2nd fluid-flow ratio can be changed continuously, the simplification of equipment, a miniaturization, and lightweight-ization can be attained. Moreover, since nozzles are not exchanged, it is applicable also to that the SUTOIKI value demanded is continuous and the fuel cell powered vehicle which changes for a short time.
[0036] Since the SUTOIKI value for which can be continuously changed to the flow rate which asks for the 1st fluid and the 2nd fluid-flow ratio, and it asks by repositioning of a needle can be acquired according to invention indicated to claim 2, it is effective in the SUTOIKI value demanded being securable.

[Translation done.]

* NOTICES *

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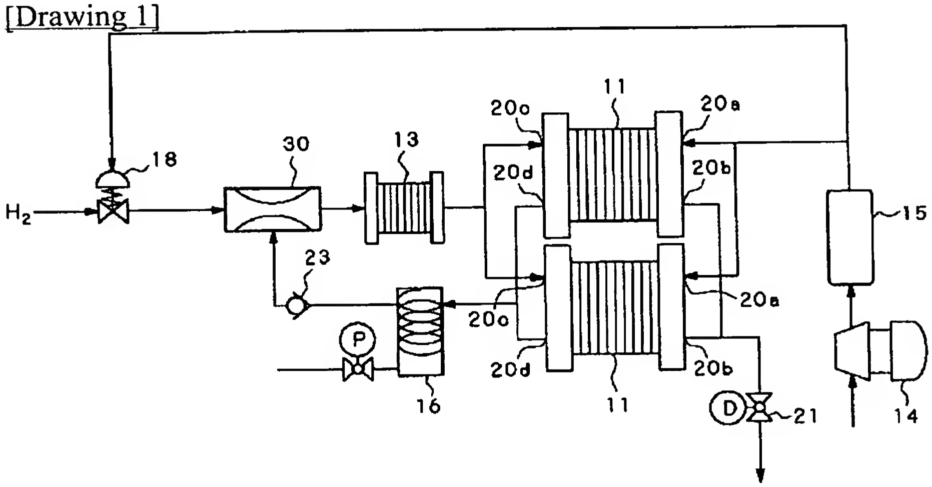
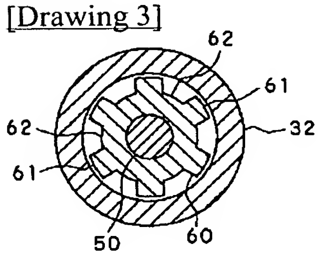
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

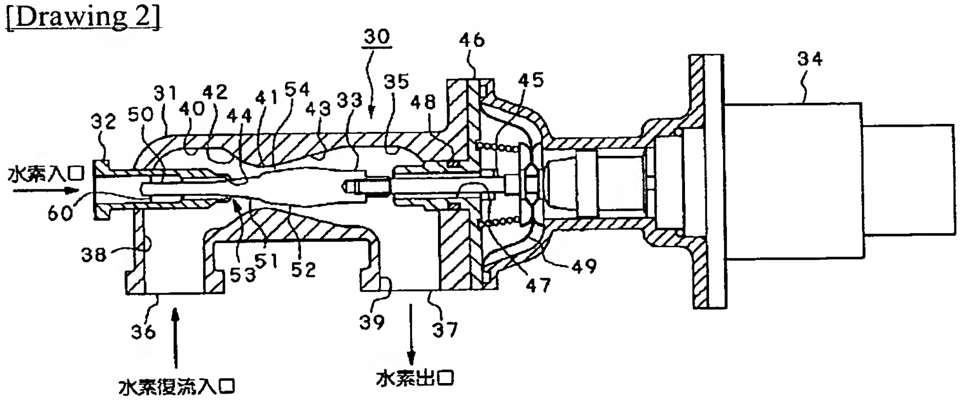
[Drawing 1]



[Drawing 3]



[Drawing 2]



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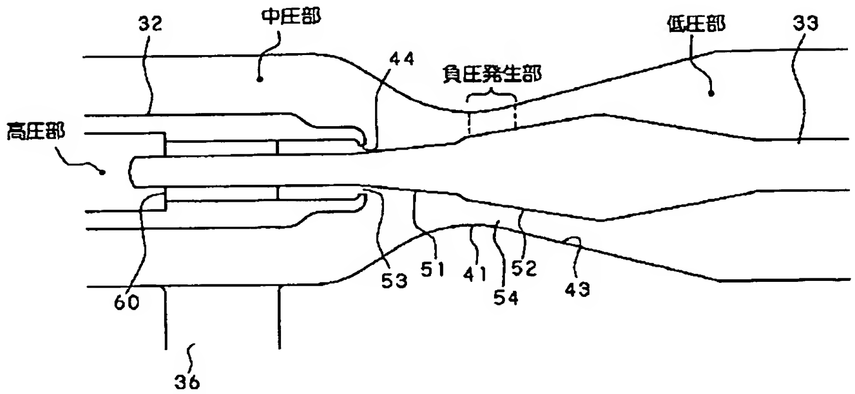

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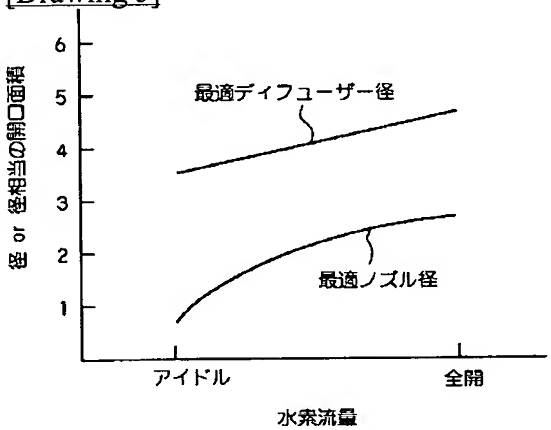

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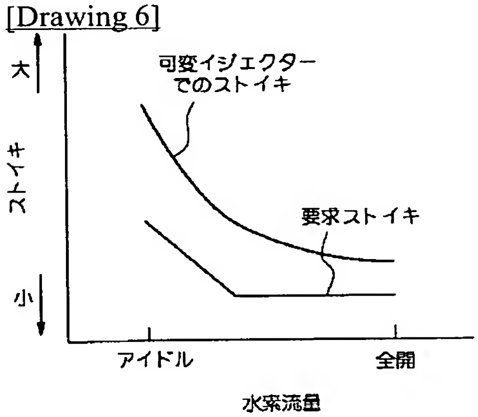
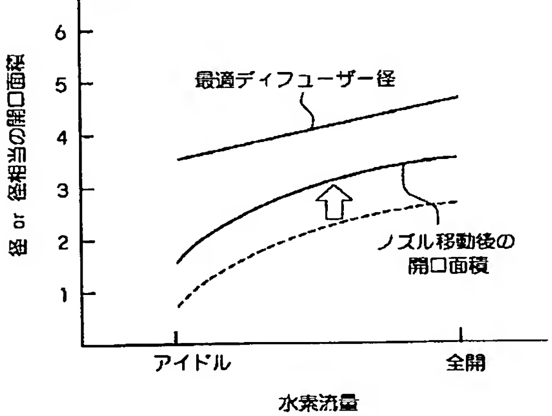
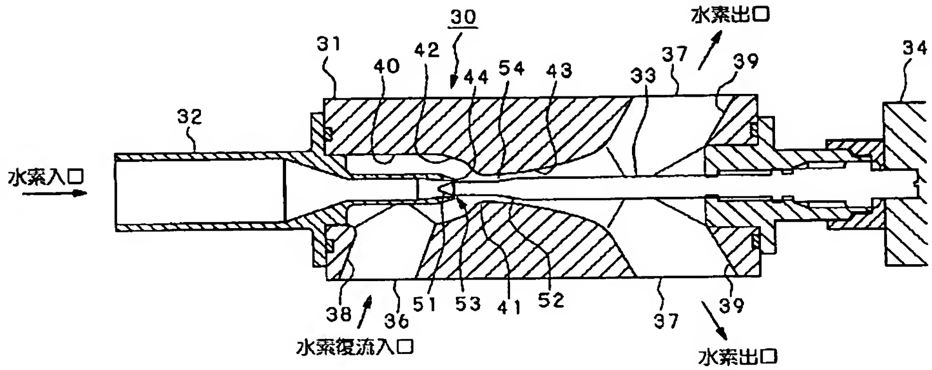


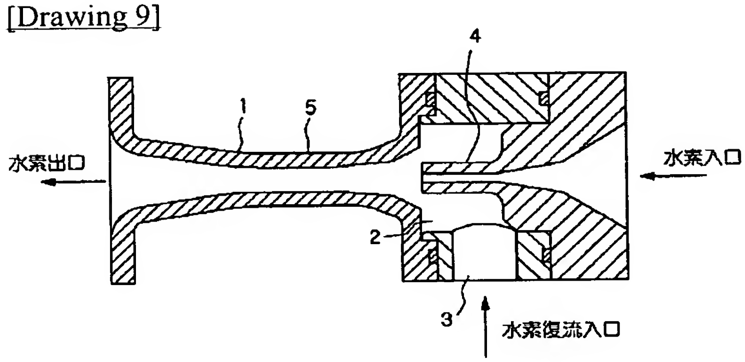
[Drawing 7]



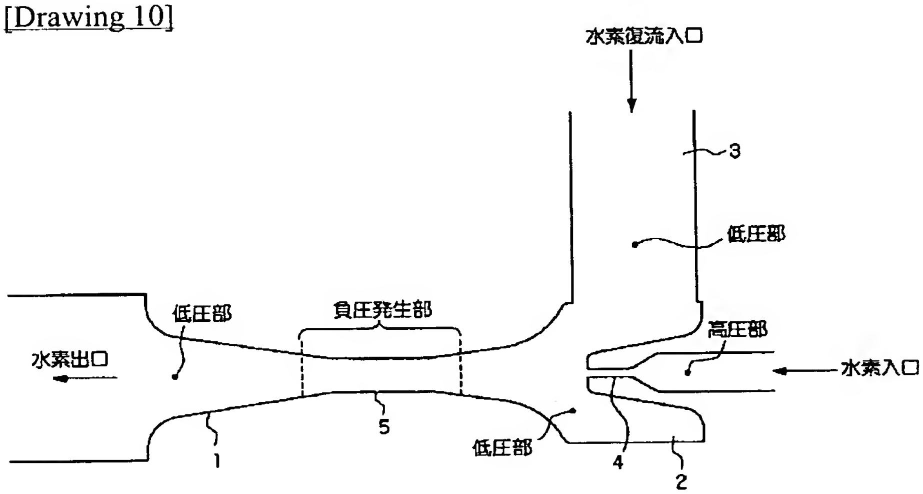
[Drawing 8]



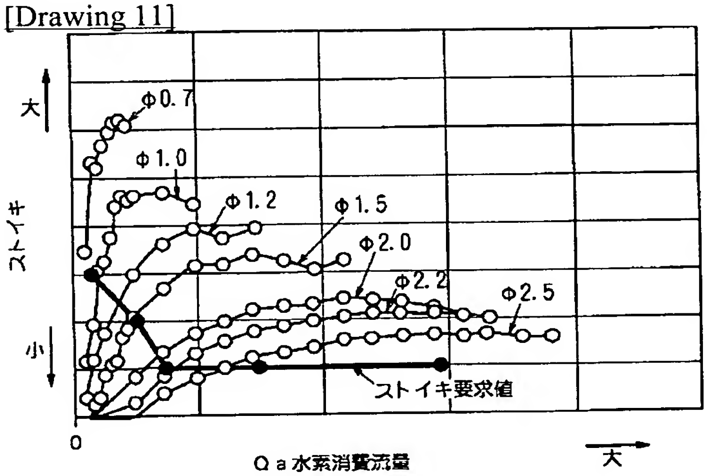
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]